FIG. 1

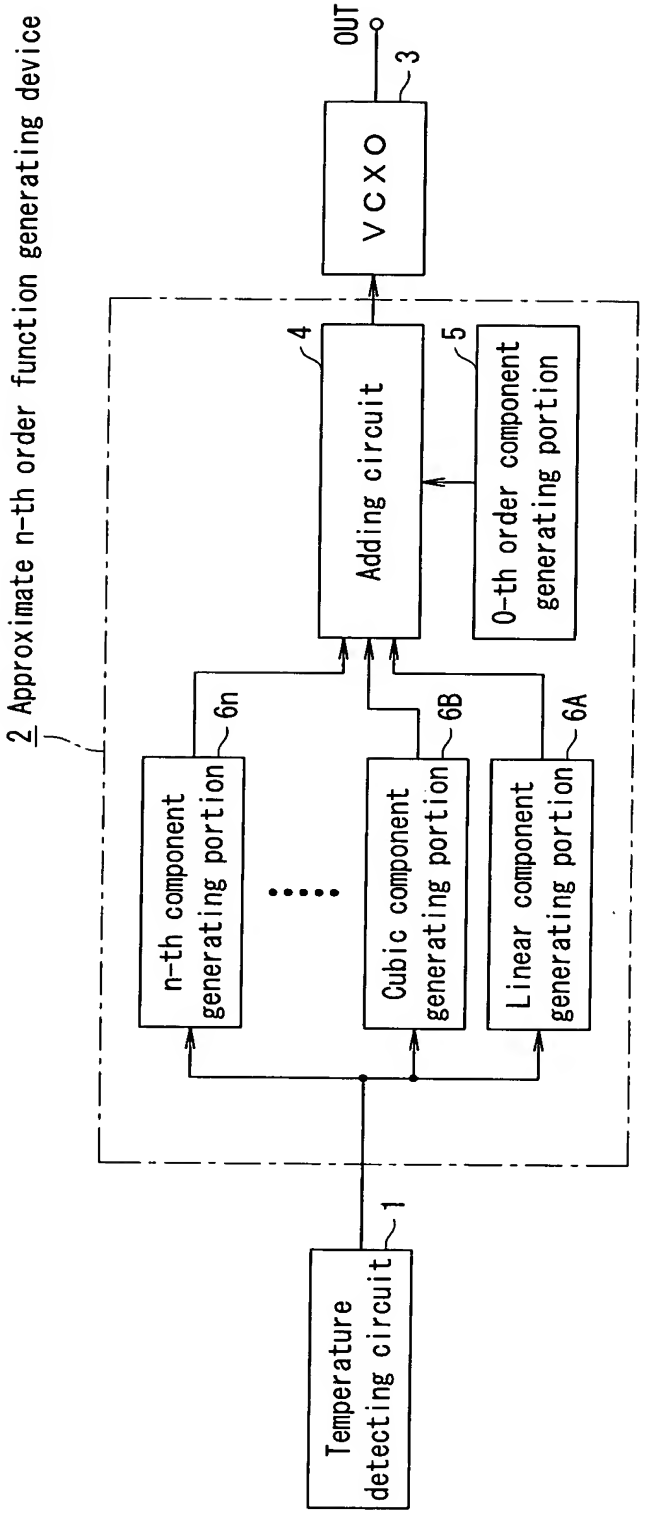
OUT
3
VCXO
2 Approximate n-th order function generating device
4
Adding circuit
5
0-th order component generating portion
n-th component generating portion
6n
Cubic component generating portion
6B
Linear component generating portion
6A
Temperature detecting circuit
1

FIG. 2

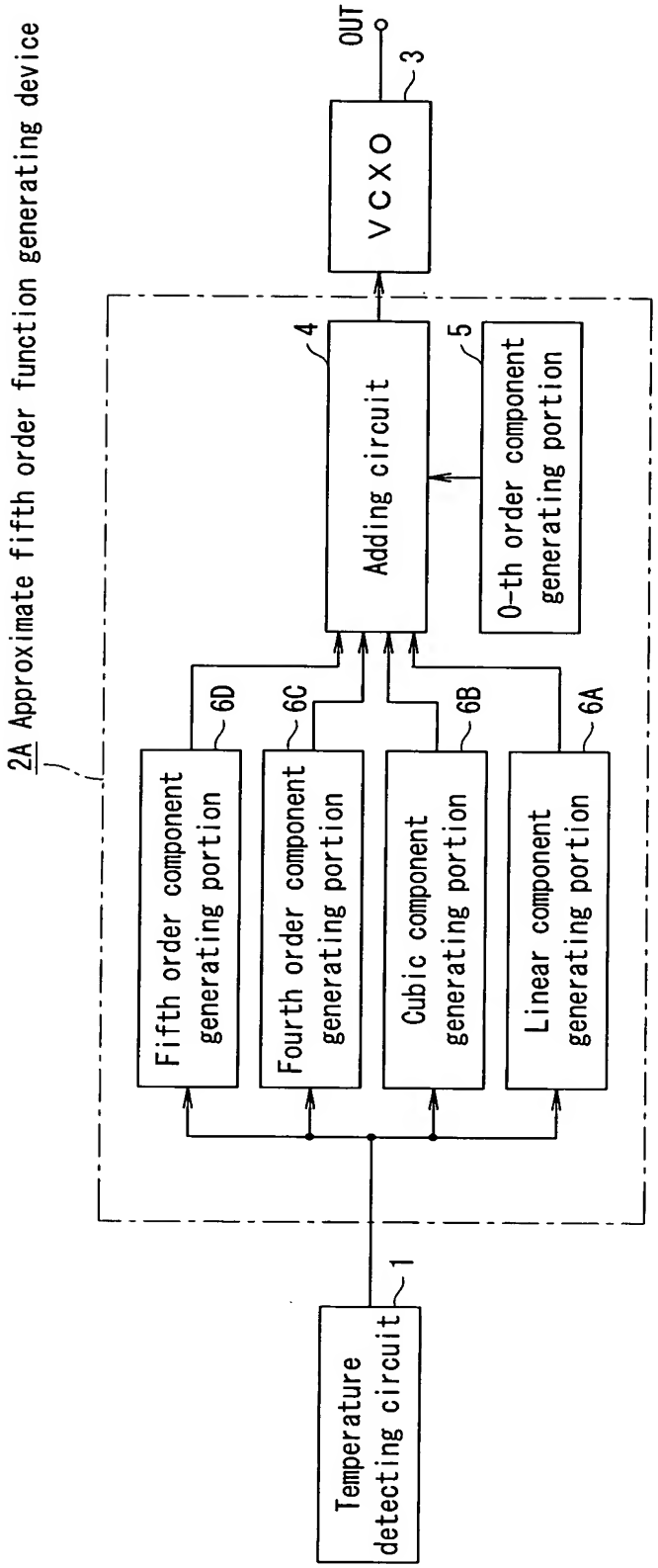
OUT
3
VCXO
2A Approximate fifth order function generating device
4
Adding circuit
5
0-th order component generating portion
6D
Fifth order component generating portion
6C
Fourth order component generating portion
6B
Cubic component generating portion
6A
Linear component generating portion
1
Temperature detecting circuit

FIG. 3

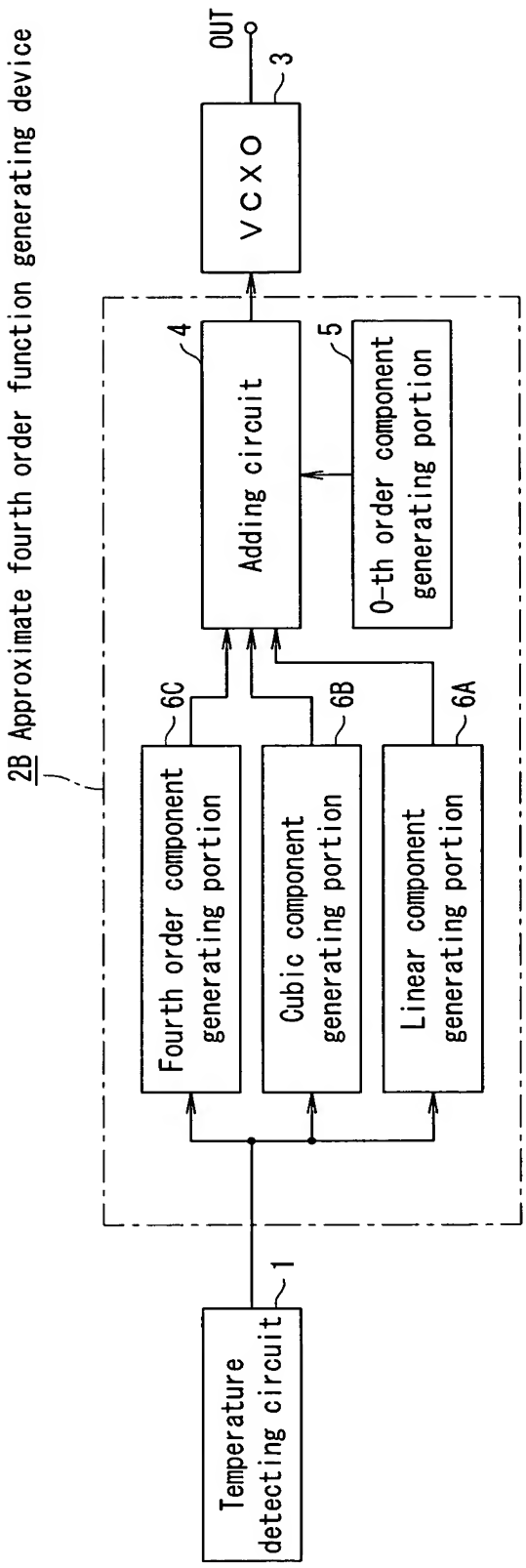
OUT
3
VCXO
2B Approximate fourth order function generating device
4
Adding circuit
5
0-th order component generating portion
6C
Fourth order component generating portion
6B
Cubic component generating portion
6A
Linear component generating portion
1
Temperature detecting circuit

FIG. 4

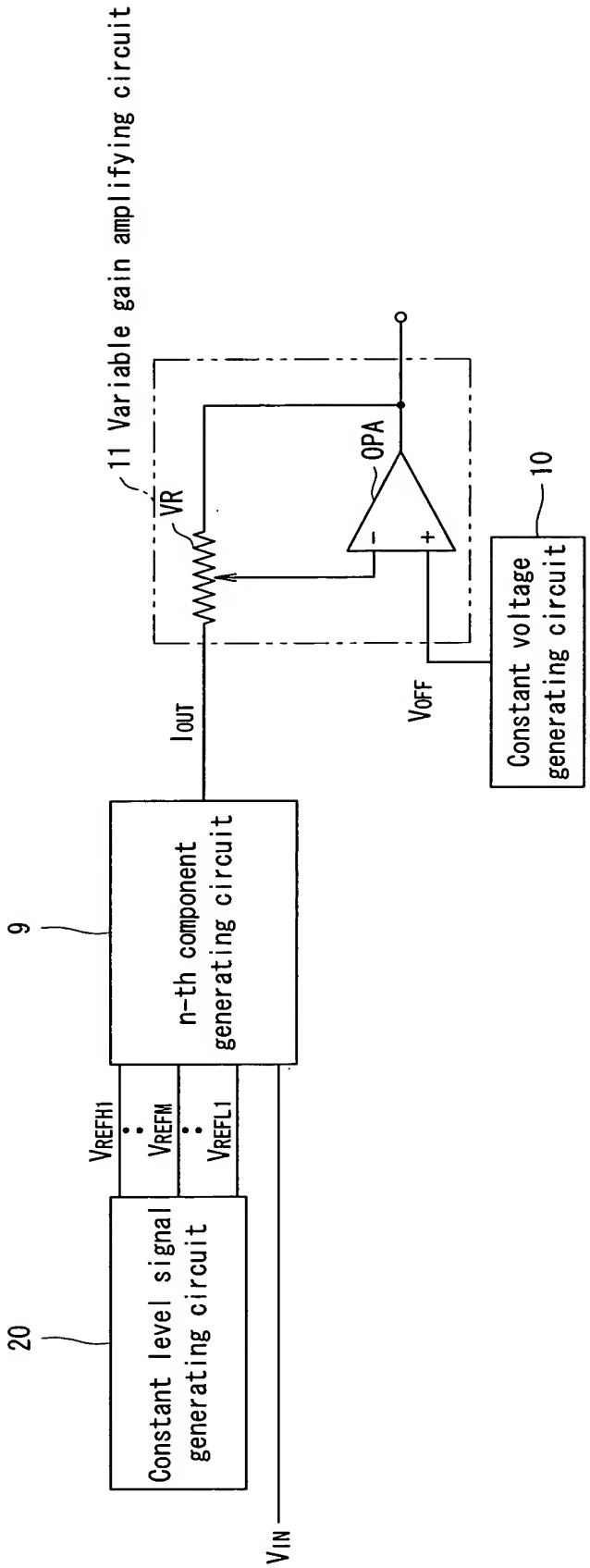
11 Variable gain amplifying circuit
VR
OPA
10
Constant voltage generating circuit
VOFF
IOUT
9
n-th component generating circuit
VREFH1
VREFM
VREFL1
20
Constant level signal generating circuit
VIN

FIG. 5

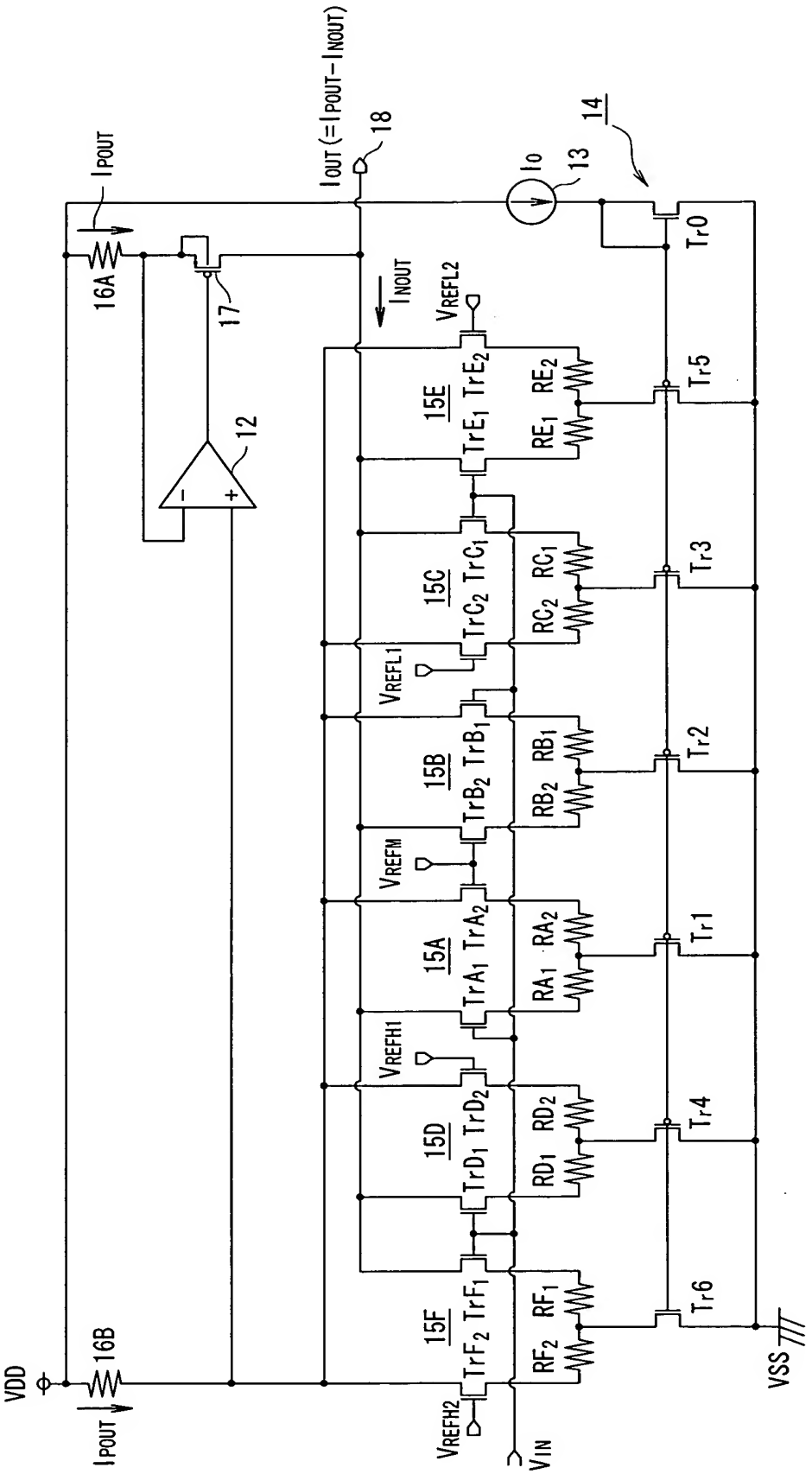
IOUT (=IPOUT−INOUT)
18
IPOUT
16A
17
12
14
13
I0
INOUT
VREFL2
15E
TrE1 TrE2
RE1 RE2
Tr5
Tr0
15C
TrC1 TrC2
RC1 RC2
Tr3
VREFL1
15B
TrB1 TrB2
RB1 RB2
Tr2
VREFM
15A
TrA1 TrA2
RA1 RA2
Tr1
VREFH1
15D
TrD1 TrD2
RD1 RD2
Tr4
15F
TrF1 TrF2
RF1 RF2
Tr6
VSS
VDD
16B
IPOUT
VREFH2
VIN

FIG. 6

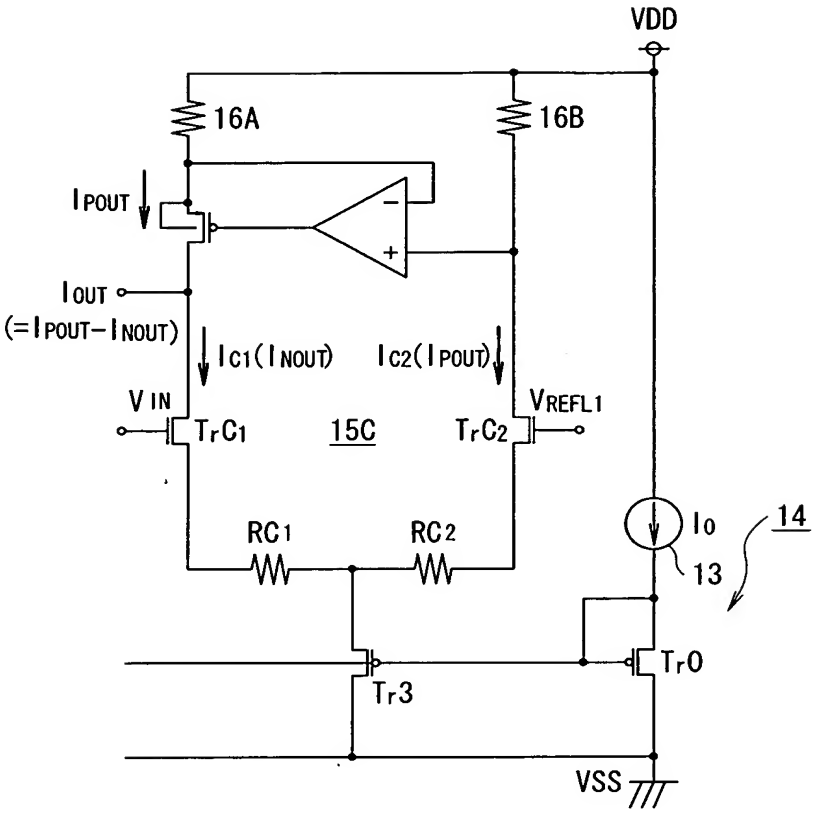
VDD
16A
16B
IPOUT
IOUT
(=IPOUT−INOUT)
IC1(INOUT)
IC2(IPOUT)
VIN
TrC1
15C
TrC2
VREFL1
RC1
RC2
Io
14
13
TrO
Tr3
VSS

FIG. 7A

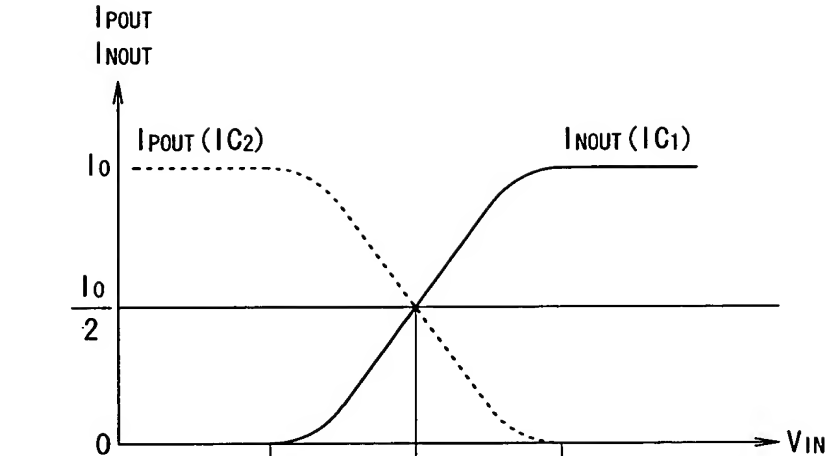
IPOUT
INOUT
IPOUT (IC2)
INOUT (IC1)
Io
Io/2
0
VIN
VREFL1
VCL=VREFL1−IoRC2
VCH=VREFL1+IoRC1

FIG. 7B

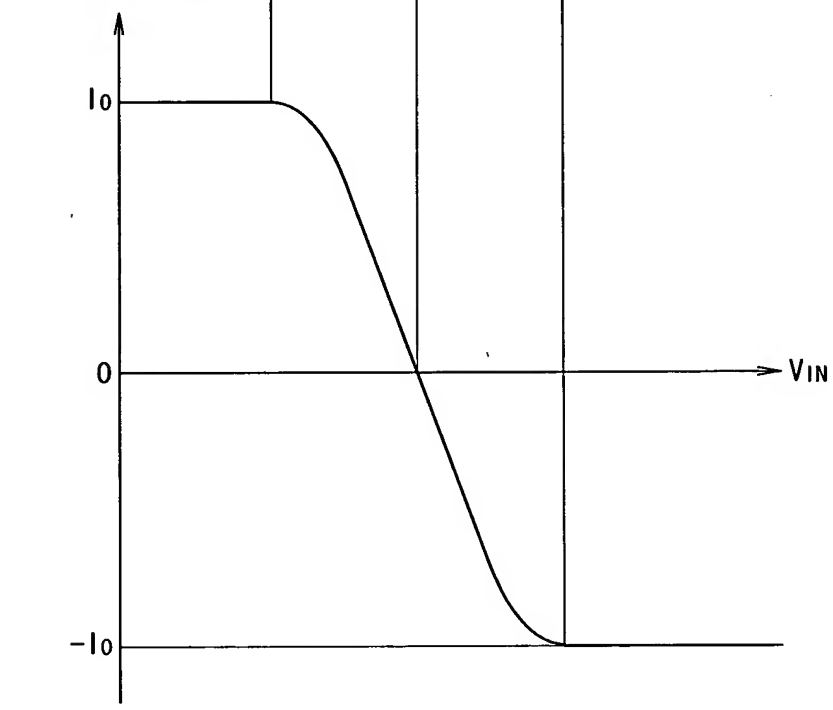
IOUT=(IPOUT−INOUT)
Io
0
VIN
−Io

FIG. 8

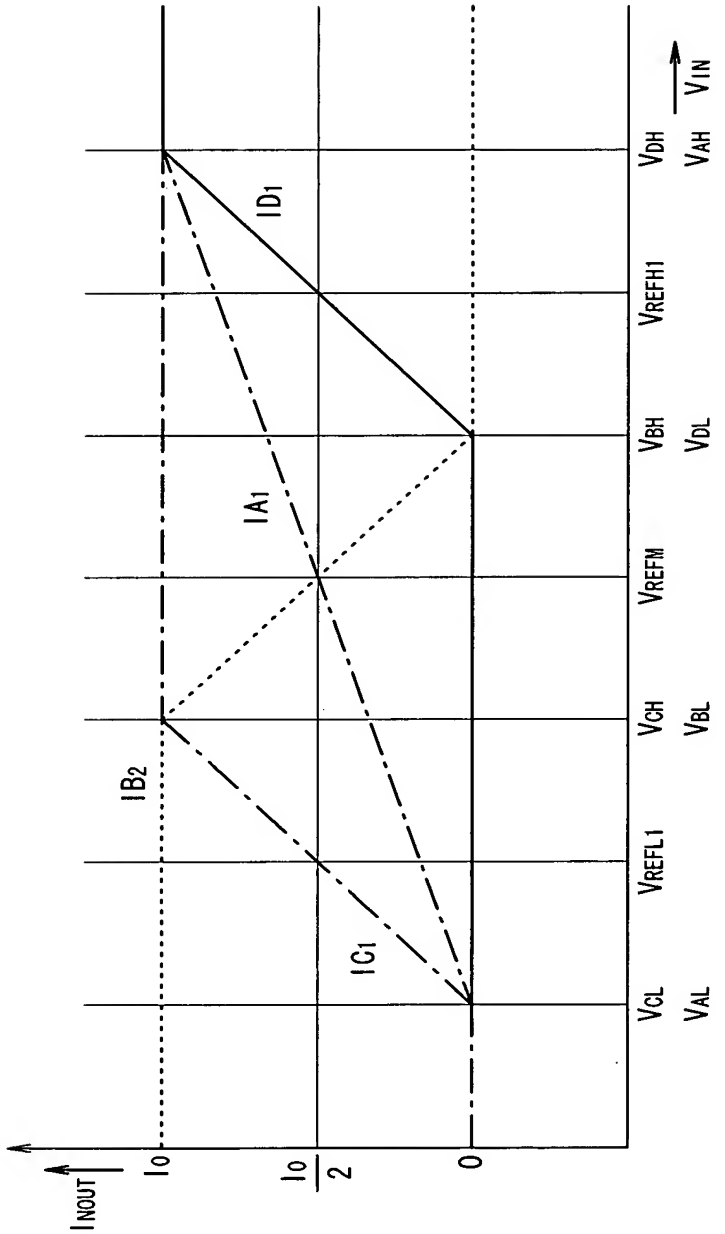
INOUT
Io
Io/2
0
ID1
IA1
IB2
IC1
VCL
VAL
VREFL1
VCH
VBL
VREFM
VBH
VDL
VREFH1
VDH
VAH
VIN

FIG. 9A

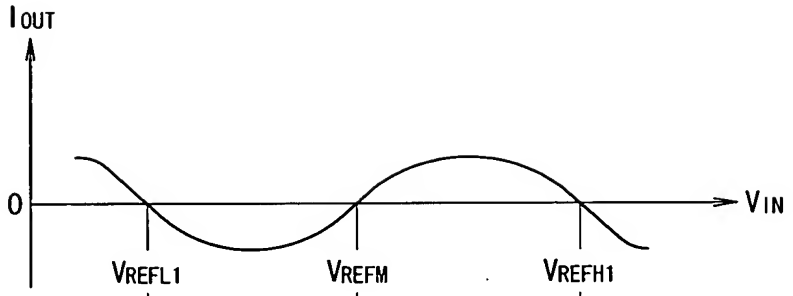

FIG. 9B

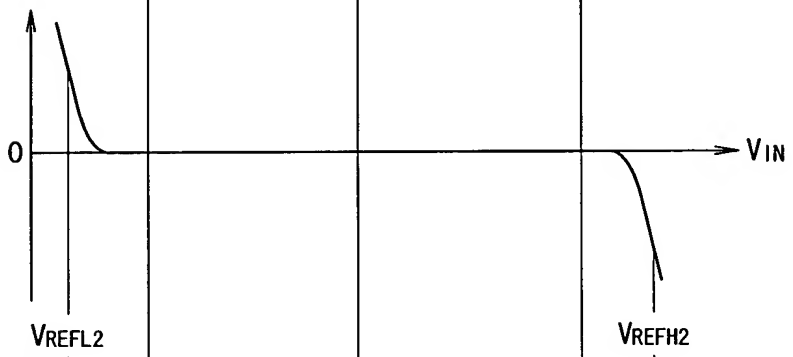

FIG. 9C

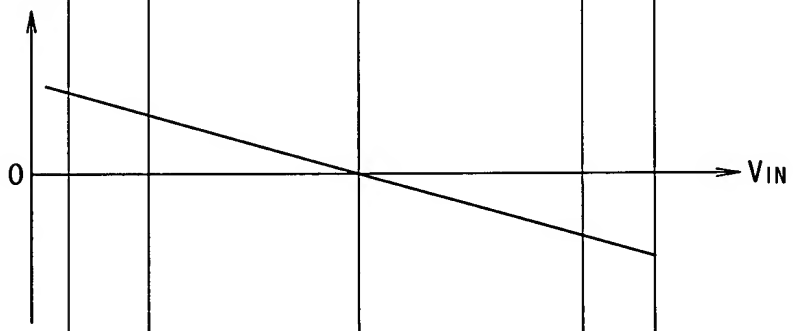

FIG. 9D

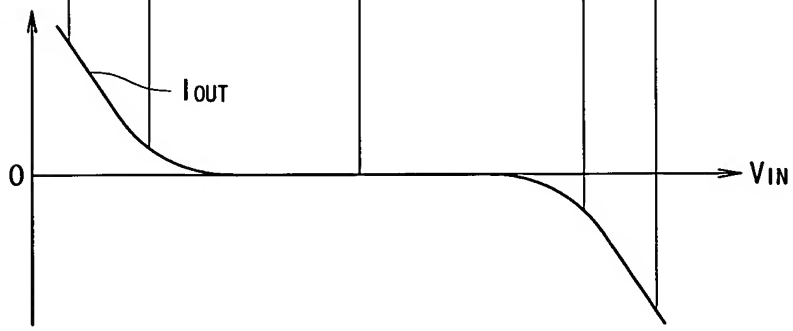

FIG. 10

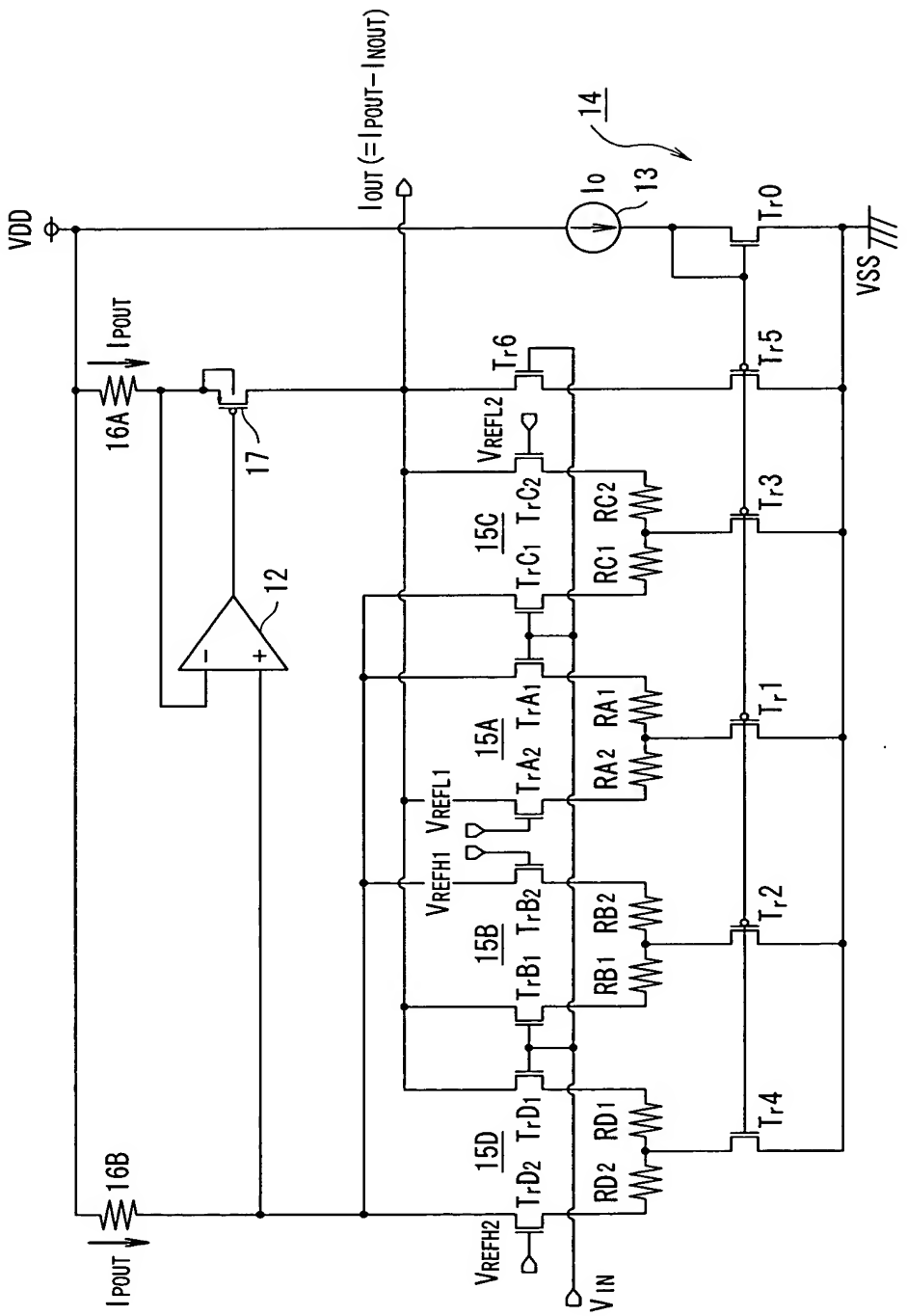
VDD
IOUT (=IPOUT−INOUT)
14
13
Io
Tr0
VSS
IPOUT
16A
17
12
Tr6
Tr5
VREFL2
15C
TrC2
TrC1
RC2
RC1
Tr3
VREFH1
VREFL1
15A
TrA2
TrA1
RA2
RA1
Tr1
15B
TrB2
TrB1
RB2
RB1
Tr2
15D
TrD2
TrD1
RD2
RD1
Tr4
VREFH2
VIN
16B
IPOUT

FIG. 11A

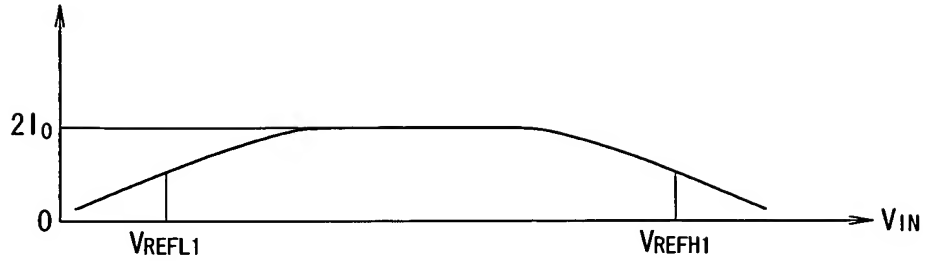

FIG. 11B

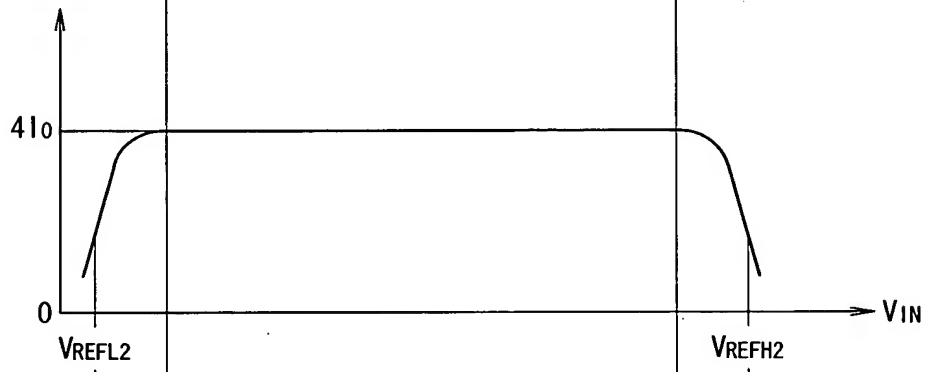

FIG. 11C

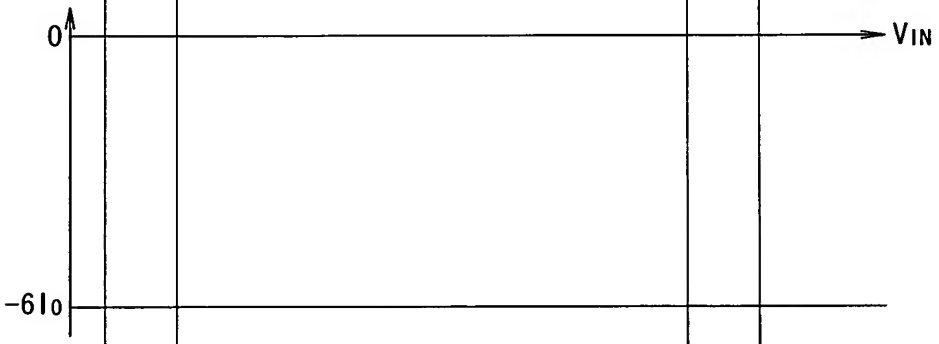

FIG. 11D

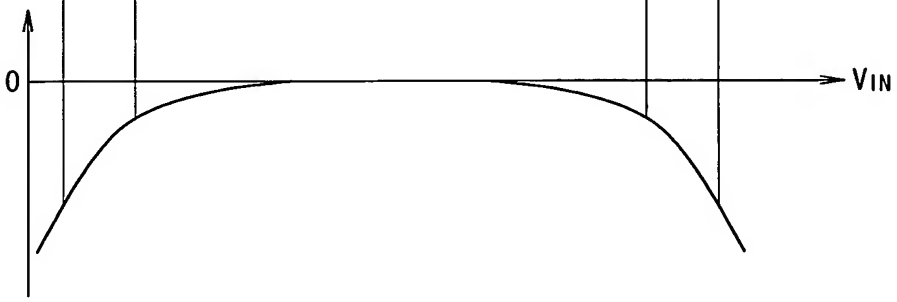

FIG. 12

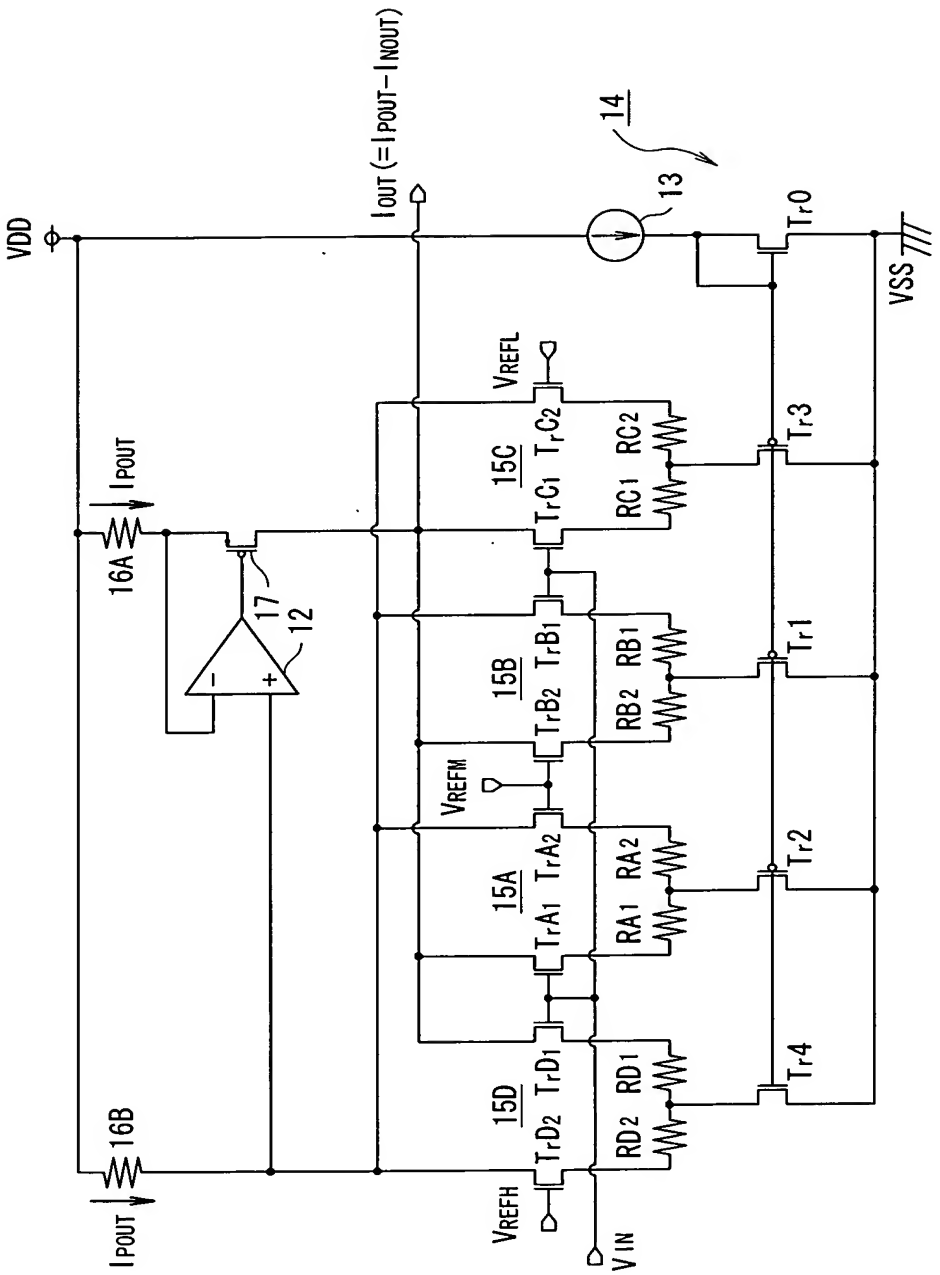
VDD
IOUT (=IPOUT−INOUT)
14
13
Tr0
VSS
VREFL
15C
TrC1 TrC2
RC1 RC2
Tr3
IPOUT
16A
17
12
15B
TrB1 TrB2
RB1 RB2
Tr1
VREFM
15A
TrA1 TrA2
RA1 RA2
Tr2
15D
TrD1 TrD2
RD1 RD2
Tr4
16B
IPOUT
VREFH
VIN

FIG. 13A

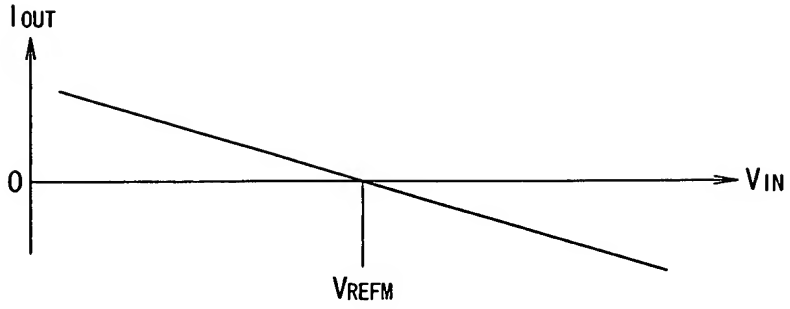

FIG. 13B

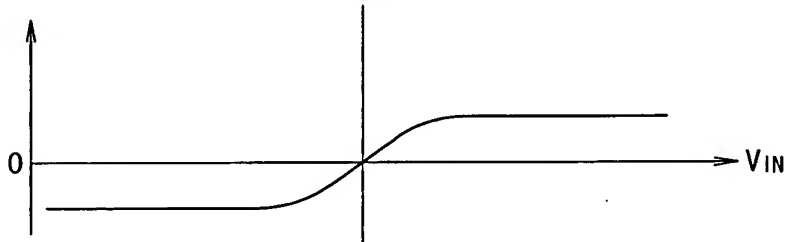

FIG. 13C

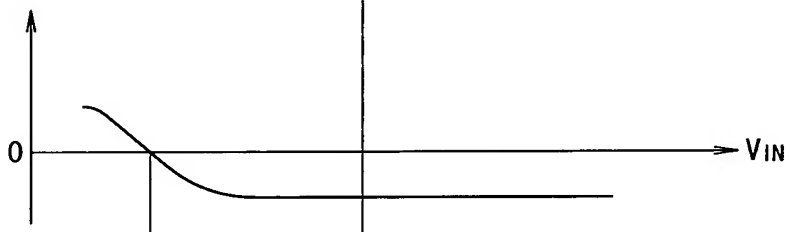

FIG. 13D

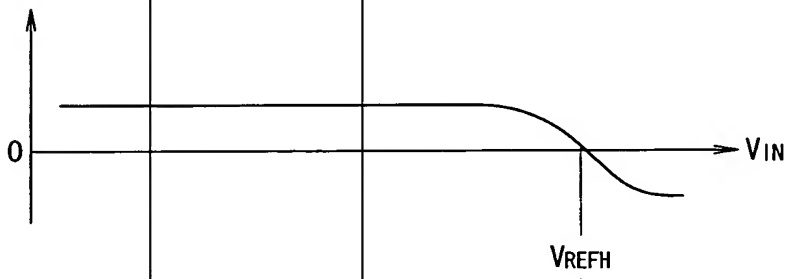

FIG. 13E

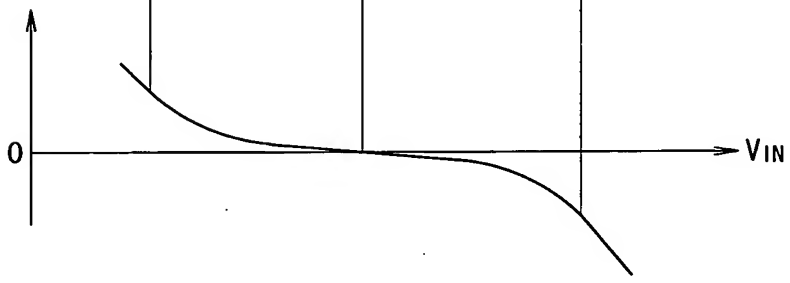

FIG. 14

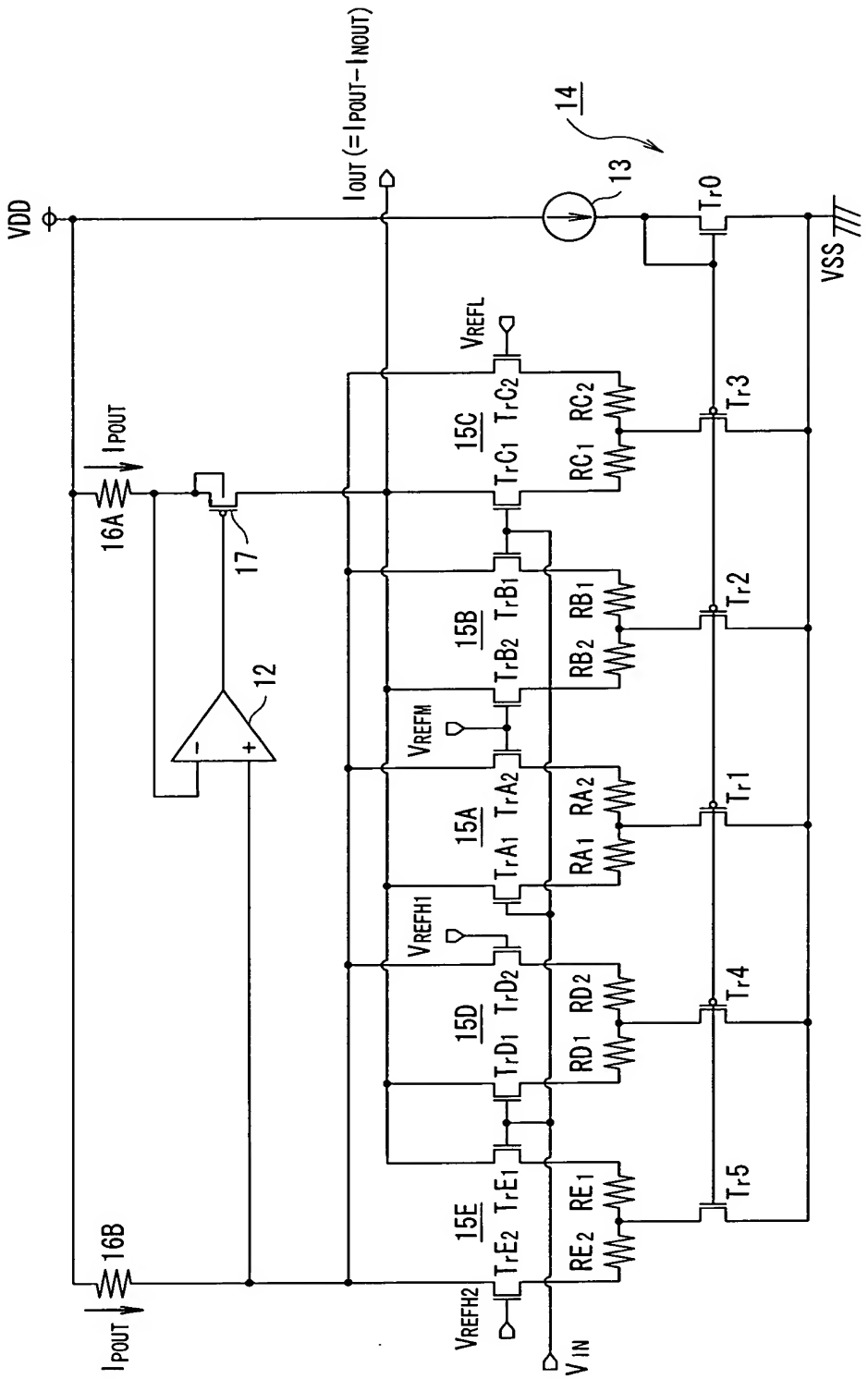
VDD
IOUT (=IPOUT−INOUT)
14
13
Tr0
VSS
VREFL
15C
TrC2
TrC1
RC2
RC1
Tr3
IPOUT
16A
17
15B
TrB2
TrB1
RB2
RB1
Tr2
12
VREFM
15A
TrA2
TrA1
RA2
RA1
Tr1
VREFH1
15D
TrD2
TrD1
RD2
RD1
Tr4
15E
TrE2
TrE1
RE2
RE1
Tr5
16B
IPOUT
VREFH2
VIN

FIG. 15A

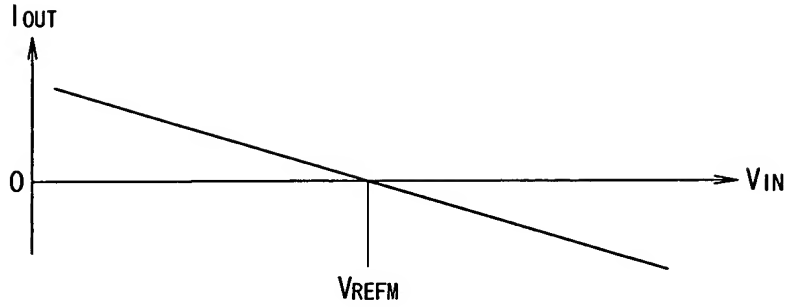

FIG. 15B

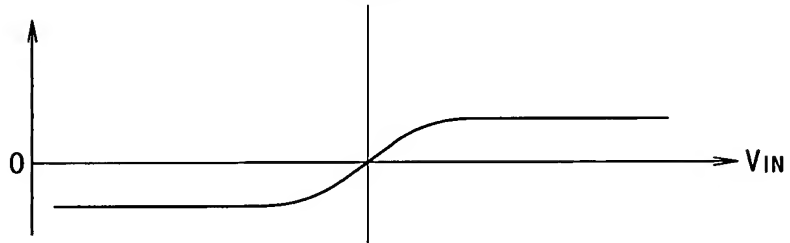

FIG. 15C

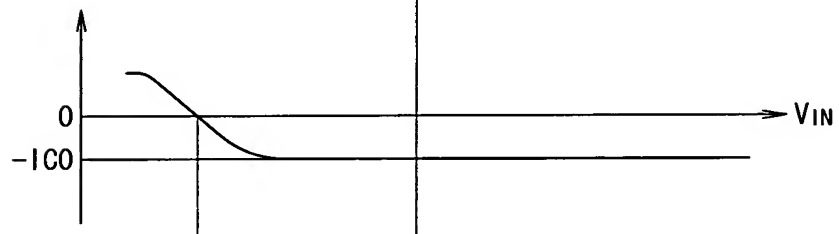

FIG. 15D

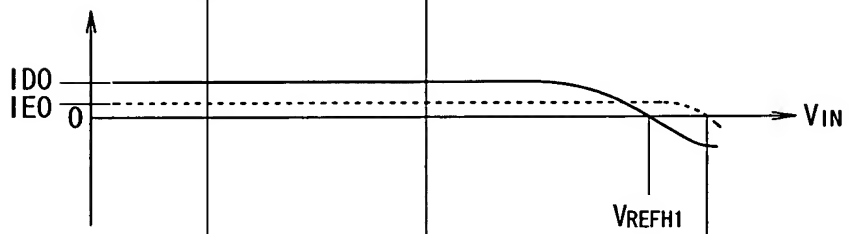

FIG. 15E

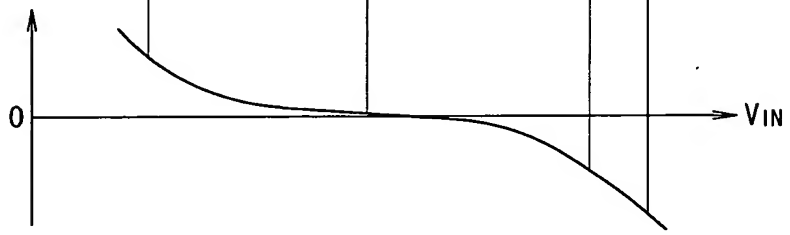

FIG. 16

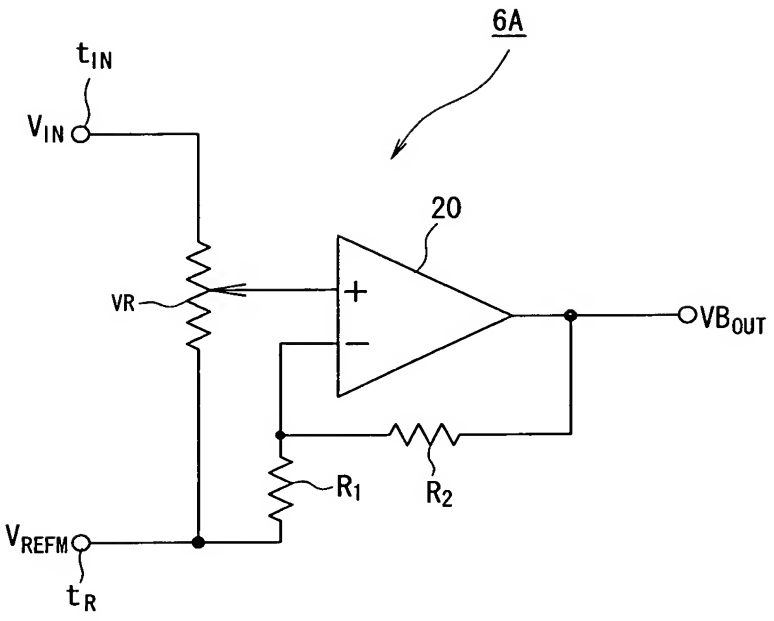
6A
t_{IN}
V_{IN}
20
VR
+
−
VB_{OUT}
R_1
R_2
V_{REFM}
t_R

FIG. 17

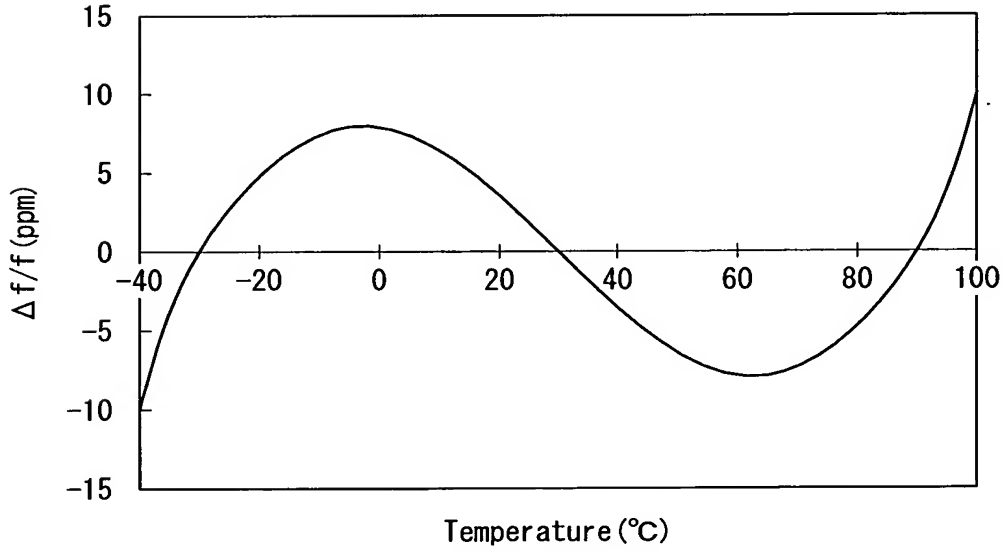
15
10
5
0
-5
-10
-15
-40
-20
0
20
40
60
80
100
Δf/f (ppm)
Temperature (°C)

FIG. 18

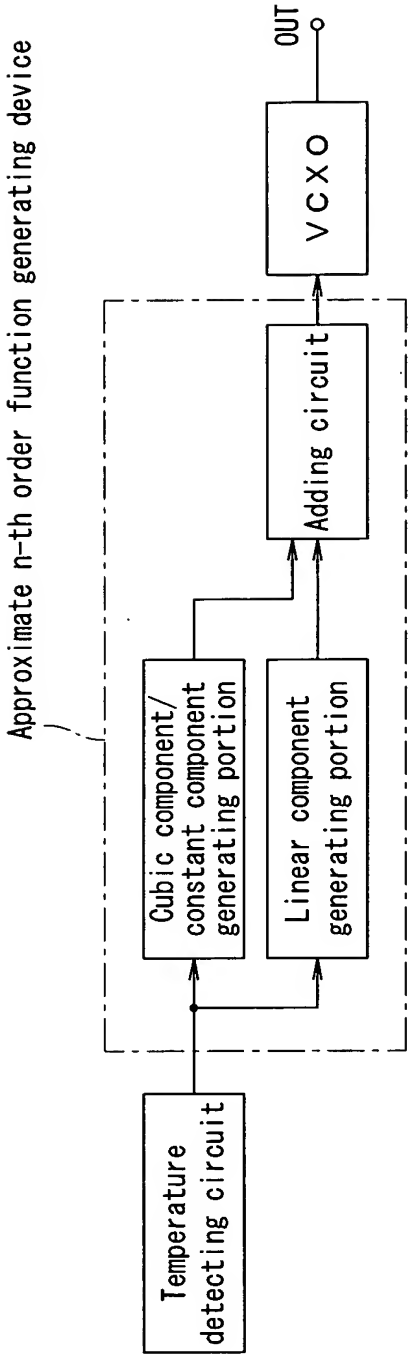
Approximate n-th order function generating device
Temperature detecting circuit
Cubic component/ constant component generating portion
Linear component generating portion
Adding circuit
VCXO
OUT

FIG. 19

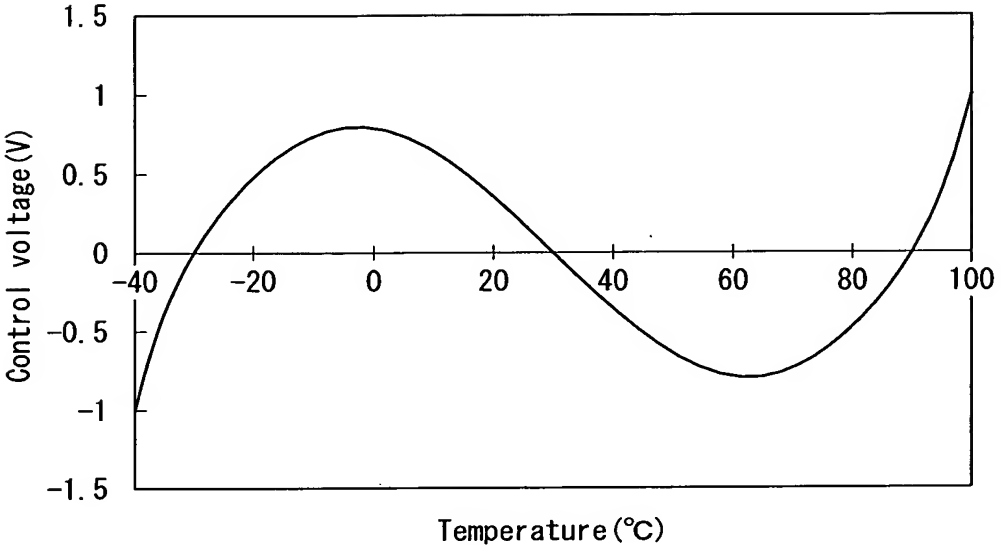

FIG. 20

$$f(t)=a_4t^4+a_3t^3+a_2t^2+a_1t+a_0$$
$$=a'_4(t-t_0)^4+a'_2(t-t_0)^2+a'_1(t-t_0)+a'_0$$

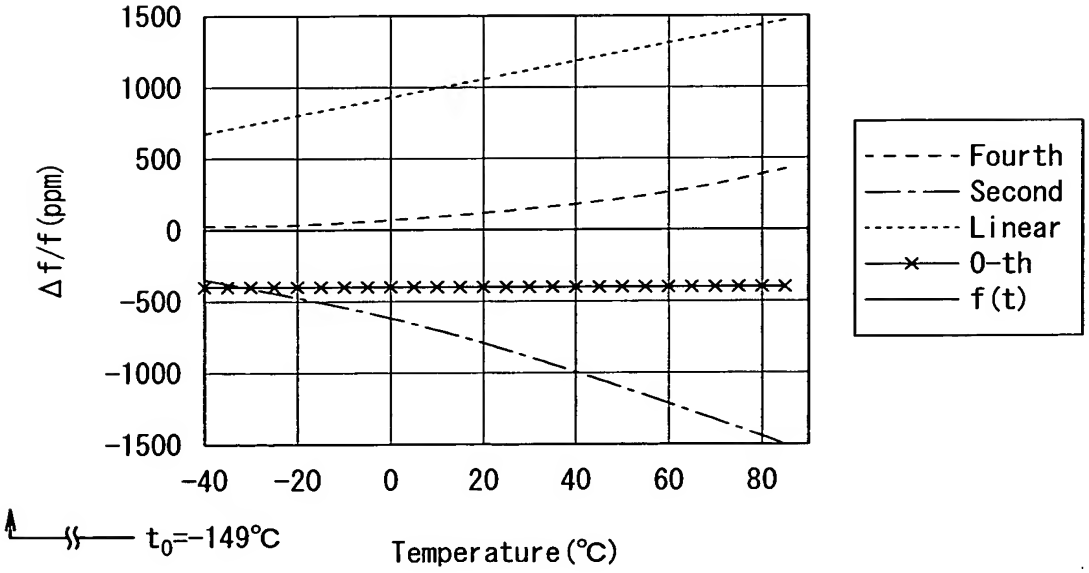

FIG. 21

$$\frac{\Delta f}{f} = f(t) = a_4 t^4 + a_3 t^3 + a_2 t^2 + a_1 t + a_0$$
$$= b'_4 (t - t_0)^4 + b'_2 (t - t_0)^3 + b'_1 (t - t_0) + b'_0$$